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MEMORY, IMAGINATION, LEARNING, AND THE
HIGHER MENTAL PROCESSES (EXPERIMENTAL)

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I. MEMORY AND IMAGINATION

(a) *Summaries and Systematic Treatises*.—Braunhausen's paper (7) summarizes certain of the well-known investigations of memory. The third edition of Offner's monograph (43) contains important additions dealing with the pathology of memory and with the intensity of memorial dispositions. Dürr's discussion of the phenomena of memory, imagination, thinking, believing and knowing (16) attempts to systematize and interpret the findings of the numerous recent investigations of these topics.

(b) *Discussion of General Questions*.—In a plea for the recognition of the existence of affective memory Sollier (52) appeals to clinical and to experimental findings. Patients who are subject to recurrent attacks frequently report a premonitory "feeling" before the onset. This feeling of *malaise* is affective rather than sensory, yet the patient recognizes that he has experienced it before; ideas may be superadded, but they are mediated to consciousness indirectly, through the medium of the directly reproduced affective states. The convalescent patient frequently reports phenomena which indicate that affective experiences leave an intensive after-effect, and that they are capable of subsequent revival. A remembrance of organic and coenesthetic experiences is equally indisputable and equally important in general mental functioning,—indeed, it is the coenesthetic memory which serves as the support

and the bond for the unification of remembrances. From a study of forty-five cases Miss Smith (51) shows that paramnesia is due to a partial amnesia of the associative processes in consequence of which the memory image becomes distorted and appears to be false. She differentiates and illustrates several varieties of paramnesia, and she discusses the significance of weakened or distracted attention in giving rise to the phenomenon. Paramnesia is not in itself an abnormal mental phenomenon, since it is but a special form of the weakening and blurring which are characteristic of all memory images. Hollingworth (24) describes the distinguishing characteristics of recognition and recall. In recognition, a datum is present as a focal component but its background or setting is lacking, while recall represents the opposite state of affairs,—where a cluster of associations is present but the desired focal component is missing. The determination to remember plays a much more important rôle in the case of recall than in the case of recognition; a single presentation has a greater imprinting value in the latter case than in the former, and the difference in imprinting value is greater in proportion as the materials employed are coherent and meaningful. In delayed recognition, various sorts of materials show characteristic differences in degree of recognizability and in effect of increased interval. Tait (56) investigated the influence of distractions, and of pleasantness-unpleasantness upon remembrance. It was found that pleasant impressions are remembered better than unpleasant, and both are remembered better than indifferent impressions; and not only is this true in so far as the impressions themselves are concerned, but they seem to exert the same facilitating or repressing influence on other impressions. Distractions are more effective in non-coherent materials than in coherent materials; forgotten words may be recovered even when their loss is apparently complete. The effect of the distraction is less when its introduction is delayed for a time after the act of learning. Bergson has differentiated active or motor and passive or imaginal memory and has asserted that the difference between these two sorts of remembrance is so fundamental as to constitute a difference in kind; Heymanns (22) points out that Bergson's distinction is at variance with the experimental findings of both normal and pathological psychology.

(c) *Imagery*.—Claparède (11) believes that the clinicians whose discussions of language and aphasia have sometimes led to the denial of the existence of verbal motor imagery have erred in that

they have not sufficiently differentiated the questions under discussion and in that they have not made sufficiently accurate observations of these exceedingly motile and elusive phenomena. Claparède is convinced of the existence of verbal motor images and he discusses the rôle which they play in language. Miss Fernald (18) investigated the mental imagery of two blind adults in an effort to determine whether they possessed tactal and visual imagery, and what individual differences were present. One subject, who was able to translate her tactal experiences into visual terms, made no supernormal use of tactal imagery; but the other subject, in whom this surrogate functioning was lacking, employed tactal imagery readily and successfully. Sylvester (55) employed eighty-five blind children in tests with the form-board. He found that those individuals who had always been blind showed the least ability in fitting the blocks into the appropriate compartments; the longer an individual had retained his vision the more successful was he in the test. It appears, therefore, that those who have ever had visual experiences retain their visual imagery and are assisted by it in interpreting their tactal impressions, while tactal imagery is less effective than a combination of tactal and visual imagery, even in those who are limited to tactal imagery alone. Ogden (44) undertook to determine what are the distinguishing characteristics of images of memory and images of imagination. Introspective descriptions, obtained from six observers in one hundred and thirty-eight memory images and seventy-four images of imagination, show that it is exceedingly difficult to discover the differentiae of these two sorts of images; the author concludes that the differentiation eludes any attempt to reduce it to such factors and conditions as were investigated in his experiments, and he is tempted to refer the distinction to imageless acts and contents. In Miss Martin's investigation (32) simple figures were presented, and the observer was asked not only to draw his visual image, but also to draw the figure on the card as he remembered it. It turned out that the observer's knowledge of the figure was almost invariably more accurate and more complete than his visual image of the figure,—they knew details of which they had no image and they could sometimes fill out lacunæ in their imagery. The author believes that these findings constitute evidence of the existence of a non-sensory remembrance; and this evidence is confirmed by the testimony of her observers. In Hunter's experiments (28) with white rats, dogs, raccoons and children, associations were first

established between the obtaining of food and the appearing of a light. The temporal interval between stimulus and reaction was gradually increased until a limit was reached beyond which successful reaction was impossible. The rats and the dogs "remembered" by maintaining gross motor attitudes of the whole or part of the body, but the behavior of the raccoons and the children indicates the presence of ideas.

(d) *Association and Inhibition*.—Burr and Geissler (9) report an investigation in which the reagent selected either member of a pair of pictures or of stories or of groups of objects, and examined it carefully. In the association-reactions which followed, the longest reaction-times invariably occurred in response to critical words; but irrelevant stimulus-words were sometimes followed by delayed reactions, and critical stimulus-words by rapid and insignificant associations. Introspection shows that the "concealing of a complex" is but a special case of consciousness under negative instruction. Sutherland (54) included ambiguous and "indelicate" terms in his list of stimulus-words, and introspections were recorded. Fifteen thousand associations, obtained from twenty-five normal adults, show that the reaction is determined not by the content of the reagent's consciousness but by his habits and his ability to adapt himself to the experimental situation, which latter has an essentially social basis; sex traumata may play a part but they are far from being the only factors which give rise to failures to react. The author criticizes the current classifications of associations; and he suggests that an artificial prolongation and intensification of parts of the reaction might facilitate the work of analysis. Duprat (15) presented words and pictures which had been arranged in such a serial order that they fitted naturally into a consecutive context; and his reagents reported their trains of images, ideas and feelings rather than simply the first idea which was evoked in each case. He found that a stimulus-word may re-arouse the same group of images, ideas and feelings in successive sittings; these stereotyped associations indicate the presence of "centers of crystallization" around which experience tends to organize itself; and these "ideo-affective syntheses" are of paramount significance in normal as well as in pathological mental functioning. Rosanoff and Rosanoff (48) report that children are characterized by fewer common reactions but more doubtful, individual, and failing reactions, than adults; associative capacity is definitely correlated with mental capacity and with school grade.

Wohlgemuth (61) again discusses the phenomenon of reversibility in the direction of associations. Experiments with nonsense syllables have shown that a syllable is more intimately associated with its successor in the series than with its predecessor, i. e., the association operates chiefly in a forward direction. Wohlgemuth finds that when colors and diagrams, instead of nonsense syllables, are employed as materials, the associations are reversible,—they operate equally well in either direction; and he explains the reversibility from the fact that vocal-motor imagery played no part in the learning of his materials. Shepard and Vogelsonger (50) report an investigation of inhibition in which an ingenious variation of procedure was employed. Their lists of syllables were so constructed that, in certain acts of learning, an association was established between *a* and *b* and between *c* and *b*,—in this case *a* and *c* were presented either simultaneously or successively, in the subsequent test; in other cases, associations were established between *d* and *e* and between *f* and *g*,—here *d* and *f* were presented either simultaneously or successively in the subsequent test; an association was established between *h* and *i*,—in the subsequent test *h* was either presented alone or in combination with a wholly novel syllable, and in the latter case either simultaneously or successively; in other cases, syllables were learned in groups of three, and variations of combination of stimulus-syllables were presented in the test. The investigators hoped by this procedure to give rise to various forms and various degrees of reinforcement and inhibition of association. A comparison of the relative lengthening of *Treffer*-time and of the relative number of correct *Treffer* under these various conditions reveals the existence of a wholly unexpected state of affairs; and they bring to light the presence of a form of inhibition which can not be subsumed under the hitherto recognized forms of generative and effectual inhibitions, nor can it be explained in terms of a division or drainage of nervous energy.

(e) *Learning and Forgetting*.—Ballard (3) describes experiments in which materials of various sorts (poems, nonsense syllables, nonsense verses, geometrical forms, Latin-English vocabularies) were partially memorized; and retention was tested, by the method of free reproduction, immediately after learning and after various intervals extending up to fourteen days. Several thousand observers, ranging from five to nineteen or more years of age, took part in the experiments, the materials being presented simultaneously to all the members of the class-room. It was found that

reproduction was more efficient after two or three days than it had been immediately after learning. The author is convinced that this increased efficiency of recall with the lapse of time is a genuine phenomenon of memory; the phenomenon occurred in about forty per cent. of his younger learners, and it became more rare with increase in age; it appeared most frequently in the recall of coherent and meaningful materials, and "it is more frequently present in subjects who casually think of the materials during the interval between learning and recall." A somewhat similar finding by Radossawljewitsch fails to find confirmation in Finkenbinder's reinvestigation of the problem (19). Finkenbinder's experiments were essentially a repetition of the work of Radossawljewitsch with the significant variation that the experimental sittings were distributed over the whole day,—in order to rule out the influence of fatigue which proved to be present in relatively intensive form at certain hours of the day. His results show, in confirmation of the pioneer findings of Ebbinghaus, that the course of forgetting may be represented by a smooth and gradual curve which ascends rapidly at first, then progressively more and more slowly. Piéron (46) also reports the results of an investigation of the curve of forgetting. A list of fifty digits was learned and retention was measured,—by methods of free reproduction and of relearning,—after intervals of seven, fourteen, twenty-eight, sixty and one hundred and twenty days. The results show that the course of forgetting may be represented by a smooth and regular curve, which does not, however, show such an abrupt initial ascent as was present in the curve of Ebbinghaus. Since several previous investigators had reported that reproduction is more efficient a few seconds (four to fifteen) after presentation than it is at any antecedent or subsequent time, von Wartensleben (58) undertook a reinvestigation of this problem. Consonants were presented by means of a tachistoscope and retention was tested by the method of free reproduction immediately after presentation, and after various intervals extending up to sixty seconds. Her results fail to establish any definite relationship between efficiency of reproduction and length of temporal interval (within these narrow limits); intervals which were most advantageous for certain learners proved to be most disadvantageous for other learners, and indeed, there were variations in the case of the same observer from sitting to sitting. This negative result is to be explained from an analysis of the exceedingly variable mental processes which run their course during

the temporal interval; and so many circumstances play a part in these processes that the learner is subject to variation from experiment to experiment. The author describes the characteristics of the process of reproducing in each of her observers in the hope that an insight into their mental types and their modes of learning may aid in the solution of the problem.

In Strong's investigation (53) of the effect of temporal interval upon recognition capacity, lists of twenty significant words were presented and read aloud by the learner. Recognition was subsequently tested by a method which consisted in presenting a second list of forty words and having the learner mark those words which he recognized as having appeared in the original list. Five learners took part in the investigation; and the fourteen intervals employed ranged from immediacy to forty-two days. It was found that cognitive capacity decreases at first very rapidly, then more slowly,—eighty-four per cent. of the twenty words being recognized correctly immediately after presentation, while only ten per cent. were correctly recognized after an interval of seven days. Recognitions which are not accompanied by a feeling of absolute certainty are little more than random guesses; the number of incorrect recognitions is relatively small, and the percentage of incorrect recognitions increases but slightly with increase of temporal interval. In *Aussage* experiments with pictures and geometrical forms, Dallenbach (12) determined the dependence of memory error upon temporal interval for periods extending from zero to forty-five days. His results, obtained from thirty-four observers, show that memory error increases directly with the length of the time interval, the increase being more rapid at the outset; that the degree of subjective certainty bears a direct relation to the objective fidelity of remembrance; that of the various attributes, form is most accurately remembered, after which follow in descending order, size, position, order and color. Cionci (10) investigated the forgetting of pictures under conditions of concentrated and of distracted attention. Complex pictures were examined for one minute, after which reproduction was tested immediately and after the lapse of five, ten and fifteen days; in the distraction experiments, the observer attended to the reading of a poem while examining the picture. Cionci's results show that under normal conditions the amount forgotten increases in direct proportion to the length of the interval which has elapsed, the absolute amount depending, however, upon the individual and varying with his mental and physi-

cal condition; in the distraction experiments, the forgetting first decreases to a minimum from which it subsequently ascends.

Ebbinghaus and others have found that when a learner is assigned the task of memorizing variable amounts of material, the increase in time required for learning the longer lists is very much greater than the increase in the amount of material. Foucault (20) undertakes to determine what is the exact numerical relation between these two magnitudes. He presented nouns in lists, varying in length from four to fifteen members, and these materials were memorized by seven learners. The results show that the time required for learning varies as the square of the number of terms in the series; and the author cites results from Binet and from G. E. Müller which confirm this finding. In another investigation Foucault finds that the amount forgotten after a given interval is inversely proportional to the length of the series,—the product obtained by multiplying the number of terms in the series by the amount forgotten is constant.

A lengthy article by Piéron (46) discusses a variety of memorial phenomenon; the findings of other investigators are summarized and discussed, and the author presents the results of his own investigations in this field. The reactions of certain invertebrates to repeated obscurations indicate the presence of a primitive mnemonic function; and the determination of the optimal interval between successive obscurations enables one to state in quantitative terms the conditions of the establishment of mnemonic dispositions. In the case of man it has been found that certain intervals between repetitions prove to be more advantageous than others. Piéron seeks to discover what is the optimal interval; his learners memorized lists of syllables and digits, the experimental sittings being separated by intervals which varied from thirty seconds to forty-eight hours. The author concludes that intervals of ten to twenty minutes' duration represent the optimum,—a finding which is to be explained on the assumption that the establishing of the memorial disposition continues for a time after the presentation has ceased. Piéron next investigates the curve of learning in its relation to the amount of material to be learned. In cases of accumulated repetitions,—where the learning proceeds continuously, without any interval between successive repetitions,—he finds that the number of repetitions required per member of series increases very rapidly with increase in the length of the series; but when consecutive repetitions are separated by an interval of appropriate length the time required

for memorizing each term of the series decreases with increase in the length of the series.

Winch (60) reports the trite observation that processes of articulation may be of service in the learning of orthography. In an investigation of the reproduction of geometrical figures, Miss Meyer (36) found that the memory errors of children differ in certain typical ways from those of adults. Children's drawings tend more than adults' to reduction and less to enlargement; the former show many more partial inversions,—through ninety degrees or thereabouts, to right or left,—than the latter; both children and adults are more prone to errors of mirror-form than to above-below confusions.

Pyle (47) assigned the task of learning to transcribe passages of prose into an artificial language made up of twenty-six arbitrary characters. The periods of practice varied in length from fifteen minutes to sixty minutes. The thirty-minute period proved to be most advantageous for the acquisition of skill. In other experiments he found that daily practice was more advantageous than twice-a-day practice or practice upon alternate days; half-hour periods of practice, undertaken daily on each of fourteen consecutive days, proved to be much more economical than the same number of half-hour periods of practice accumulated within a single day (with intervals of thirty minutes between the practice periods); indeed, in the latter case, no further improvement appeared after the third period, and there was even a lapse of efficiency after the eleventh period. In an investigation by Misses Browning, Brown and Washburn (8), blindfolded subjects were trained to sort cards into compartments; in one case the successive sortings were made without interval, in another case, with distraction intervals of one minute. The results show that about one hundred and fifty per cent. more repetitions were required for the attainment of a given degree of skill in the 'no interval sortings' than in the 'interval sortings'; and the superior advantage of distributed repetitions is more marked in the learning of more difficult materials. Kline and Owens (30) publish a preliminary report of an investigation of the acquisition of skill in the sorting of cards. By ingenious variations in the nature of the task assigned to the learner, they aimed to analyze and differentiate the stages in the act of learning, and to throw light upon such factors as interference, transfer, attention and affective tone.

Horwitz (27) presented letters, words, and pairs of words which

were subsequently reproduced, either freely or by means of the *Treffermethode*, after intervals which varied from fifteen seconds to two minutes, with and without distraction during the interim. These experiments were performed upon twenty-seven abnormal subjects, including thirteen hystericals, thirteen psychopaths and one paranoiac; and three normal subjects were included for purposes of comparison. The results show that hysterical and psychopathic patients are not usually defective in remembrance of recent events within an interval of two minutes, although such a defect is sometimes present. The most markedly disadvantageous effect is due to a distraction of attention; and this effect manifests itself in a failure to remember the relative positions of the presented material rather than in a forgetting of the material itself. In Boring's investigation (4, 5, 6) eight dementia praecox patients were submitted to tests in order to measure their noting capacity, their immediate memory span, their apperception capacity, their capacity to follow instructions, and their motor control in such activities as tapping and aiming at a target. Then the author undertook an investigation of their acquisition of skill in reproducing an extent, in cancelling symbols, in finding their way through a printed maze, and in the weaving of rugs. In addition to the objective results, introspective descriptions were obtained from the patients. It was found that dementia praecox patients are capable of fairly accurate motor adjustments, but they show large individual variations in their ability to learn, in their mode of procedure, and in the consciousness which accompanies the performance. The course of consciousness which accompanies their learning of the maze is similar to that of the normal subject; visual and attitudinal factors dominate at the outset, but these usually give way subsequently to kinæsthetic factors, and these in turn finally lapse as the performance becomes automatized. The introspective descriptions of the dementia praecox patient are very incomplete as compared with those of the trained normal subject, and they are sometimes rendered unreliable by the interpolation of irrelevant statements. One may, however, obtain from the dement a reliable description of the general trend of his consciousness.

Abramowski (2) points out that according to the teachings of current psychology, no psychical vestige remains after a stimulation has ceased; all that is left is a physical modification in the nervous system, and nothing but a restimulation or a representative association can bring about a mental revival of this physical state. He

urges that this envisagement of the situation has been shown to be false by his investigations of "cryptamnesia."¹ Past experiences are conserved not only in the form of physiological processes but also in the form of mental contents which possess an essentially emotional character. Every experience leaves behind it an "emotional equivalent"; these "equivalents" accumulate and coexist but they lose neither their individuality nor their power to reinstate remembrances. The author's "law of the emotional survival of forgotten data" states that in passing into obliviscence, perceptions are transformed into the affective equivalent of that which followed them in consciousness; the antecedent disappears as a perception but persists as an emotional survival of that which followed it. Haggerty's discussion (21) cites Jennings's familiar observation of modifiability of behavior in stentor; such a case of modified behavior can not, however, be adequately explained by supposing that the discrete stages are now "passed over rapidly and in a modified fashion," for there is no indication that these stages are now present at all. An appeal to the synapse, in the case of the higher animals, is equally unavailing because we still have upon our hands the mystery as to why the synaptic resistance to the passage of the nervous current should be greater or less at any one time than at any other time. The psychologist's difficulty is due to the fact that his conception of nervous functioning has been too static and too mechanical. The author advances the view that physiological states, instead of being isolated and self-contained, tend to radiate and to mingle with other physiological states and even to extend to states which are temporally removed from them. The single cortical cell, endowed with the properties of primitive animal protoplasm, may then become the vehicle of several physiological states at the same time; this conception of linear and lateral irradiation simplifies the explanation of the phenomena of learning.

Two important German contributions to this general topic have been made more accessible to American readers by Ruger's and Baird's translations (17, 35); Thorndike's *Psychology of Learning* (57) will be reviewed elsewhere in the BULLETIN.

(f) *Intention and Determination.*—Myers's study (42) of incidental memory consisted in determining the accuracy with which the sizes and dimensions of familiar objects (coins, stamps, bank notes) could be reproduced by a large number of individuals of

¹ For a summary of the results of these investigations see this BULLETIN, 1911, 8, 248; 1912, 9, 325 f.

different ages, occupations and degrees of education; and the accuracy with which materials could be reproduced when they had been perceived without the expectation that they were to be remembered. It was found that most observers wholly fail to remember their "incidental" experiences. The attitude of the subject is an important factor in perceiving and learning, both of which are essentially selective processes. Aall (1) presented objects and stories to six hundred children, ranging from seven to sixteen years of age. In one case the pupils were told that their reproduction of these materials would be tested after the lapse of several weeks or months; in another case they were given to understand that the test would be made on the following day but the test was really deferred for four or eight weeks. It turned out that the accuracy of reproduction was invariably greater in the case where the pupils had learned the material with the intent to remember it for a considerable period,—the difference being nine per cent. in the case of the objects, and twelve per cent. in the case of the stories. Langfeld (31) reports an investigation of voluntary movement under positive and negative instruction. In one case the reagent was instructed to trace a line along the middle of a groove; but in another case the instruction was negative: "Do not touch the sides of the groove." In most instances the movement proved to be more accurate under the positive instruction, but in certain reagents the opposite tendency appeared. Introspection showed that the mental content varied with the variation in the instruction; certain reagents required visual and kinæsthetic imagery in order to execute the movement, but an image of the intended movement was not necessary in every instance; the most frequent content was a representation of the result to be attained. The reagents who relied most upon a non-represented determining tendency were most successful in executing the movement,—which leads the author to suggest that progress in muscular control is inversely proportional to the amount of imagery employed.

(g) *Practice*.—G. E. Müller (38) reports the results of a recent reinvestigation of Dr. Rückle, the mathematical prodigy. The previous investigation had taken place six years before, and in the meantime, Rückle had been engaged for four years in giving public exhibitions of his feats with numbers. It seems probable, then, that any improvement which has taken place is to be regarded as a product of this daily practice. Rückle's memory for numbers (measured in terms of the time required for the memorization of

large groups of digits) has improved by approximately forty per cent. (He can now memorize a list of two hundred and four digits in less than nine minutes as compared with eighteen minutes in 1906!) But in the meantime, the time required for the memorizing of consonants, syllables and colors has increased by more than fifty per cent. This paradoxical result is doubtless to be explained from the fact that his learning of numbers is now almost exclusively of a rational and ingenious sort, and that he feels uncertain and unskilled in mechanical memorizing. Müller's paper also reports the results of an investigation of Rückle's processes of recognition, and of his present procedure in learning and reciting; a description of his marvelous feats in computation is added. In Kirby's investigation (29) pupils of the third and fourth-year classes were practiced in addition and division for periods of equal duration, but of different distribution,—the total practice-time being divided into from two to twenty-two equal divisions for different groups of children. It was found that in the addition experiments, with seven hundred and thirty-two pupils, the median ability of the group increased by approximately forty-five per cent. as a result of forty-five minutes' practice; in division a median percentual gain of seventy-five per cent. resulted from fifty minutes' practice. The shorter period of practice proved to be considerably more advantageous. The permanence of the practice effect was measured at the close of the school-year in June, and again after the re-opening of school in September (the practice experiments had been completed, in all classes but one, in April or May). It turned out that there was a considerable loss of ability both in addition and in division, during the summer vacation; but on resuming the practice it was found that an average of thirty minutes of practice was now sufficient to bring the group to the same degree of efficiency as had been attained at the end of fifty minutes of practice in the preceding spring. In Phillips's experiments (45) sixty-nine pupils of the sixth, seventh and eighth grades were tested in "arithmetical reasoning" and in "the fundamental operations of arithmetic"; employing the results of this test as a basis he divided the children into two groups of as nearly equal ability as possible. And one of the groups was given ten minutes' drill daily in "fundamental operations of arithmetic" and in "arithmetical reasoning," the drill continuing through two school months. Then the initial tests were repeated in both the drilled and the non-drilled groups, when it was found that the former had improved fifteen per cent. more than

the latter in "fundamentals," and fifty per cent. more than the latter in "reasoning." Donovan and Thorndike (14) report an investigation in which the adding of columns of digits was practiced by twenty-nine school boys of the fourth grade for a period of sixty minutes; the practice was distributed over thirty periods of two minutes each, and it was undertaken twice daily for the five school-days of the week. The average improvement of the group was approximately sixty-four per cent. as a result of the hour's practice; the gross amount of improvement is approximately identical in the case of the group which possesses the least initial ability and the group which possesses the greatest initial ability. Hill, Rejall and Thorndike (23) report an investigation of the acquisition of skill in typewriting; two subjects practiced the writing of both "old" and "new" material, daily for a period of five months. The results show that the learners improved progressively from an average initial efficiency of eight words per minute to an average final efficiency of thirty-nine words per minute, in the case of the old material; while in the case of the new material, the corresponding scores were seven and twenty-four. The curve of learning shows, in all four cases, an initial rapid ascent followed by an approximately straight line. In a subsequent test, four and a half years later, it was found that the improvement was relatively permanent; five hours of additional practice sufficed to attain the same degree of efficiency as had been attained in thirty hours of practice in the original experiment.

Meyer (37) argues that it is unjustifiable to carry over the concept of training from the muscles to the nervous system; nervous function is not capable of such an improvement and a facilitation as is muscular work. Neither the sense-organs nor the acquired nervous functions can be trained. The training of activities and feats of skill is wholly a matter of memory and of the establishing of associations between the aim of the movement and the execution of the movement. Mechanization comes about chiefly by means of constellations in the associative processes; and the volitional factor must be included among these constellating components, for the intention has a constellating effect throughout. A movement does not become involuntary as a result of practice; it merely becomes a component of a goal which includes it, and the will includes the whole series in a single act of consciousness. Attention and will can be trained only through memory; attention is improved in consequence of familiarity with the material, and the will is im-

proved exclusively as a result of habituation in definite action. All training is due to memory, but memory is not due to any form of training.

II. INTELLECTUAL PROCESSES

The second edition of Meumann's *Intelligenz und Wille* (34) contains sixty-one additional pages of text, and a much-needed index has been added. The author's views are not essentially changed; the most important additions have been made to the sections which deal with wishing and acting, and with willing from the purely psychological point of view, although in numerous other sections the author's statement has been clarified and definitized.

Westphal's procedure (59) consisted in assigning a principal and a secondary *Aufgabe* to his observers; it was found that the content which represents the solution of the *Aufgabe* may be present to consciousness in widely different ways. These differences lead the author to differentiate five degrees or levels of consciousness: (1) the datum may be present to consciousness in such a vague and fragmentary fashion that its existence can only be inferred; (2) it may be present as an unrelated content, the observer being unaware of any activity on his part; (3) the datum may be observed under the direction of a specific *Aufgabe* in which case it gives rise immediately to a state (4) where the solution of the *Aufgabe* is potentially known—the observer knows the colors, the forms, etc., but he can not formulate his knowledge; and finally (5) these details are actually known, the knowledge being formulated in verbal or attitudinal terms. These degrees of consciousness do not represent mere differences in clearness of content; they have to do with the observer's relation to the content.

Hollingworth (25, 26) finds that the accuracy of the individual's judgment regarding the efficiency of his own performance varies with his degree of confidence; and that as we pass from relatively automatic motor activities to activities of a more strictly mental character, we find that progressively larger variations in performance must be present in order to give rise to judgments of a given degree of confidence. Judgments of the efficiency of one's own as well as of another's performance are based upon affective criteria. In discriminating weights, pitches and the like, the judgment tends to be directed toward the "positive" stimulus, although the second stimulus is also favored slightly. Judgments of similarity and of difference are based upon different criteria, the former upon grosser and more general properties and the latter

upon more minute details. Judgments of similarity and of difference are not merely two different forms of expression of a single intellectual act; each involves its own peculiar mental processes and criteria; that which is most similar is not for that reason the least different. Similarity seems to be a more fundamental, natural, easy and self-consistent category than difference.

Müller-Freienfels (39) calls attention to the fact that ideas never appear apart from attitudes, feelings and motor tendencies; the more consistently one's thinking is directed toward a goal, the more intensive are these attitudinal, affective and motor components,—it is only in the dream-life that the concrete content of ideas predominates. Processes of comparing and of generalizing are each the product of a specific attitude; and the investigation of memory has shown that attitudes and generic feelings are more permanently retained than sensory data. In a discussion of the general idea, the same author (40) points out that a perception is much more than a mere fusion of sensations. Feelings and movements also play a part, and the character of generality which attaches in some degree to all perceptions is the peculiar product of these affective and motor concomitants. Not only are these affective and motor concomitants reproduced in every reproduction of a perception, but they play a major rôle in the reproduction and the reproduced sensations play a minor rôle. A certain degree of typicalizing has already begun in the act of perceiving, and in the act of ideating the typicalization is carried to a higher degree. The general idea is usually a particular idea which has not only lost its details but which now appears in another context and with other affective concomitants; the general idea differs from the particular idea only in degree and in function. Our ready comprehension of figurative and ironical expressions shows that the understanding of meaning is not dependent upon concrete ideation,—indeed, in many instances, the current meaning of such expressions could not be understood if ideation took place; understanding consists essentially in an arousal of feelings and of a readiness for action. In a third paper (41) Müller-Freienfels undertakes to differentiate the chief types of imagination and thinking, on the basis of certain fundamental differences of apperception: (a) Certain individuals are interested chiefly in the special case with its peculiar characteristics, while others seize upon the typical in every experience. This difference reveals itself not only in external apperception but also in the highest levels of abstract thinking, because

apperception furnishes the material for all thinking. Impressionistic naturalism and typicalizing idealism in art, concrete empiricism and abstract idealism in philosophy are the product of thinkers of these two types. While this individual difference is largely a product of adaptation and adjustment, and is due in part to one's profession and to the needs of one's environment, yet there is usually a congenital bent toward one type or the other,—and this bent is probably to be explained from a keener sensitivity of the sense-organs or from a greater plasticity of the higher cortical centers. (b) A second differentiation of types is based upon the circumstance that certain individuals regard the world at large as being more static, while others regard it as being more dynamic; for the former type of individual, that which is at rest is more significant, while that which is in motion is more significant for the other type. This difference in type is to be explained psychologically from a more or less dominant motor endowment of the individual. (c) A third pair of types owes its differentiation to the fact that we tend to take up an attitude toward the objects of experience. The objective type of individual observes objects in an impersonal fashion and refrains from mingling his own feelings with them; the opposite type takes a definitely subjective attitude toward objects and adds a subjective component to the objective datum. The former type is attracted to the exact sciences, the latter to ethics, aesthetics and religion. In addition to these three fundamental pairs of types, the author discusses the possibility of various combinations of types.

Selz (49) points out that psychology has not succeeded until recently in accounting for the unity and the coherence which must characterize the creations of the genius if they are to prove acceptable. The course of ideating and thinking proceeds toward a goal; and the setting up of the goal is found to initiate such intellectual operations as are adapted to its attainment. These operations consist in the reproducing of a content and then in performing certain activities of abstracting, selecting and combining. A peculiar coöperation of a whole series of such activities is usually necessary if a problem is to be solved. In certain instances, this appropriate coöperation is made possible by the fact that problems of a somewhat similar nature have been solved before; in such cases of more or less definite knowledge of both means and end, the reinstatement of the appropriate operations in appropriate sequence is a relatively simple matter. The author also discusses cases in

which means and end are unknown but are discoverable, and cases in which accidental discoveries of the past are now either employed as means or are set up as ends.

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MEMORY, CONCEPT, JUDGMENT, LOGIC (THEORY)

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In succinct and classic form, Ward (16) treats of the problem of biological heredity and memory. The solution advanced depends on the doctrine that required traits are inherited, but it implies also, what Ward believes is too often forgotten, that no clear manifestation of heredity of acquired traits should be expected until "the functions that have led to structures have passed far beyond the initial stage where conscious control is essential to their performance." Weismann's theories are subjected to fundamental criticisms. The principle of continuity forbids the assumption that the developmental process abruptly changes when we pass from unicellular to multicellular organisms. There is no ground

for separating organic life from psychical. All life is experience. Ontogeny and heredity are aspects of a single process. What habit and memory are for the individual heredity is for the race. The key to the nature of the continuity between body and germ is to be found in social intercourse rather than in physical transmission. It is possible to hanker unduly after a physical explanation of the *modus operandi*. The mnemonic theory requires not merely physical records or "engrams" but living experience or tradition.

Hollingworth's suggestive study (11) of the comparatively neglected process of recognition is based mainly on experimental data (secured for the most part in experiments performed for other purposes), the theoretical implications of which, however, are not wholly disregarded. It is held probable that schematically the mechanism of recall and of recognition involve a common neural pattern operating in reverse "directions" in the two cases; also, that a more careful study of the laws of recognition will throw light on various other processes concerning which there is still much to be learned.

Bréhier (4) attacks the prevalent intellectualistic view that concepts are relatively stable and fixed and that images are, in a depreciatory sense, relatively shifting and inconstant. This view overlooks a large range of data of quite the opposite implication. Bréhier points out that it has been often the case that it is the image that changes not, while the significance of the image, the ideas and the concepts, that were originally bound up with it, undergo profound alteration. Numbers (in the case of the early Pythagorians), early Greek myths, religious symbols of the Jewish faith, all afford instances of images which as images remain fixed while the meanings attached to them shift and develop. The main thesis is that because the image is permanent and because conceptual thought is transitory, an image tends to become symbolic. Three moments are distinguished: (1) image and idea as primitively associated, (2) a dissociation, and (3) a reassociation. The second moment arises through criticism through the effort to constitute in place of a world thinkable in terms of imagination a world thinkable in terms of logic. The influence of Comte seems to be plainly in evidence here; but in discussing the third moment Bréhier chooses not the Positivistic but the Realistic way. In the reaffirmation of the symbolic image he finds the characteristic of realism. From the standpoint of critical idealism the symbolic image is only an unnecessary duplication of the idea, whereas for realism it is a necessary method of approximating to reality.

Ribot (15) holds that the doctrine of imageless and wordless thought is an importation of metaphysics into psychology. After canvassing evidence adduced in support of the doctrine, paying especial attention to the data of mysticism, he concludes that the hypothesis is very improbable, and in any case is not proved. The partisans of this doctrine have, in his judgment, taken too simple a position in limiting themselves exclusively to what is in consciousness. They forget unconscious activity, which may have a psychic import. Here Ribot plainly inclines to the doctrine of unconscious cerebration. Thought entirely empty of any conscious image is not totally empty; unconscious activity has its own manner of working in the solving of problems; consciousness attests unconscious activity, but it does not constitute it.

The traditional study of logic continues to fare hard at the hands of those who are interested in a more psychological or scientific study of the subject. Müller-Freienfels (12) expresses the belief that the study of thought processes still suffers from the traditional view of ideas and concepts inspired by logic, and essays an analysis of concepts from a strictly psychological standpoint. He finds that thought processes when thus directly approached are seen to be not purely intellectual or ideational in the abstract sense, but are much more the expression of feeling and of preparation for action. Also in another article (13) he reaches a similar conclusion that the theory of the ideational processes has suffered from the domination of an intellectualistic interpretation. Thought is above all a reaction, an active attitude, not mere receptivity. And it lives in terms of feeling, not narrowly defined as pleasure-pain states of mind (or as if they corresponded to the black-white visual experiences of the color-blind), but with an infinite variety of shades, tones and combinations. Goblot (8) represents the tendency to free logic from embarrassing reminiscences of its ancestral form, language, to relieve it of all unnecessary linguistic impedimenta. His remarks are directed mainly to the modality and the quality of judgments. From a strictly logical point of view, he concludes, it is incorrect to admit the existence of modality of judgments. There are only judgments of modality. As to the quality of judgments, he rejects the view that there may be a third, indefinite sort, for this admission would destroy the principle of contradiction, the essential law of judgment. In a second article (9) Goblot points out again that verbalism has obscured what is essentially logical. A treatment of judgment forms stripped of their usual verbal

accompaniments is the desideratum. Then hypothetical judgments become in form categorical,—the assertion or the denial, as the case may be, of possibility, particular or general.

Anschütz (2) holds that the psychology of thought processes offers a field for scientific investigation which has only as yet begun to be cultivated. He offers a brief statement regarding methods of investigation: introspection, the interpretation of evidence furnished by other minds, both normal and pathological, and the utilization of the material afforded by the study of the development of language. This is incorporated in his book on Intelligence (3), in which he combines the results of a variety of theories and investigations bearing on the subject, introduced by an historical sketch of the problem. A summary of the psychology of attention is the backbone of this work. There are applications to educational and to individual psychology in methods of testing degrees of intelligence and in the determination of complex types of intelligence.

Anschütz's exposition of Lipps's new doctrine of the judgment (1) is demanded, according to the author, by the marked development which the doctrine has undergone since the issue of Lipps's work on logic in 1893. The earlier view of judgment defined it as an association of ideas. The later view emphasizes thought as a fundamental process of which judgment represents the highest stage of development. Anschütz has set forth the view with great detail, the first part of which is devoted to the psychological analysis of the judging process, and the second to a description of different species of judgments, both intellectual and affective.

Hicks (10) comes to the rescue of the principle of identity which as '*A* is *A*' has more than paid the penalty for the tautology of its formulation. "*A* is *A* is a predicative formula. It has betrayed modern logic into the error of treating identity solely as a predicative principle, whereas it is primarily a principle of stable values." After a critical review of modern discussions of identity, the author seems to regard the doctrine of evolution in its extreme, Heraclitean form to be the most serious menace to the principle of identity. Even here, however, we may successfully resort to Bosanquet's view that identity is a postulate and not a law. And this postulate is not out of harmony with actual conditions in a changing world, and at the same time quite sufficient for both epistemology and logic.

Driesch's monograph (7) is a contribution to logic conceived as *Ordungslehre*. Out of the Cartesian-like postulate "I experience

something" Driesch spins a web of concepts of ordered and ordering experience. Logic becomes the most explicit expression of the active and determining tendency of thought to order its world. Logic is the experience itself of the value of this ordering as a problem and also the experience of the will to solve this problem.

Couturat (6) maintains that it is beside the mark to oppose to logic the psychological fact of invention. The mind which invents is identical with the mind that demonstrates. Intuition is conceived of by the logicians as intellectual intuition, in the Cartesian sense, not intuition in the Kantian sense. Couturat's algebra of logic, now translated (5), presents a brief and many-sided view of the subject; and is of value, also, in pointing out with great clearness its limitations: The algebra of logic marks an advance in breadth and universality over the traditional logic, to which it belongs, being at bottom the theory of classes considered in their relations of inclusion or identity. But logic ought to study many other kinds of concepts and relations. Thus the algebra of logic is a mathematical logic by its form and by its method, but it must not be mistaken for the logic of mathematics.

Translations of Poincaré's writings on Science and Hypothesis, The Value of Science, and Science and Method have been issued in a single volume with an introduction by Royce (14).

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READING

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The experiments of Wartensleben (5) are based on the earlier investigation of Finzi regarding the influence of the length of the interval between the perception and the reproduction of visual stimuli. Finzi has found that the best reproduction does not take place immediately after the first fading of the impressions and that an interval of four seconds is the most favorable one for correct reproduction. Wartensleben fails to confirm these results and finds no constant relation between the length of the interval and the correctness of reproduction. However, the interval has an undoubted influence which varies with the typical differences of the various subjects and with the nature of the processes which take place during the interval. The paper contains a detailed analysis of these processes and also a discussion of recognition and certainty based on the subject's introspective record.

Valentine (4) has made an investigation of the comparative merits of the word and phonic methods of teaching reading. The material used was English words expressed in Greek characters so as to approximate the conditions in which a learner is placed in beginning to read. In a preliminary test on training school students, he found that those who had been trained to read such words by the phonic method were slightly superior to those trained by the word method. In reading new material, the former were superior to the latter to the extent of 200 per cent.

With different classes of children of about eight years of age, the results were similar, so far as new words were concerned. The word method in general gave better results in the recognition of words on which the children had already been drilled. The difference in results, however, was not clear cut in every case and varied with the methods of the instructor in giving the lessons by the two methods.

The author puts especial emphasis on the results obtained from experiments on children who had been reading only a year. In this class, aged six and one half years on the average, the phonic method appeared the more effective, both in respect of old and new material. Some evidence is presented which appears to show that the word method is relatively more effective with duller children.

In view of the fact that the youngest children tested had already been learning to read for a year and because of the obvious difficulty of making the conditions of teaching the two methods fair to each, these results must be regarded as tentative, though the investigation is a very interesting attempt to reduce the problem to an experimental basis.

Brown (1) makes a more comprehensive and hopeful attack on the same problem. He proposes a unit of measurement for reading proficiency, based on rate of reading, and quantity and quality of reproduction. Experiments on schools of New Hampshire, where the children were taught reading according to different methods of instruction, appeared to show that the non-phonetic method is more valuable, especially in the lower grades. The present article is one of a series, the remaining numbers of which will appear later.

Pintner (3) makes a plea for more silent reading and less oral reading in the schools. The test of the ability of children of the fourth grade to reproduce the meaning of what was read orally and silently showed a slight superiority when silent reading was used.

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GRAPHIC FUNCTIONS

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The investigators of writing from the pedagogical side show increasingly a clearer and more definite conception of the problems to be solved. Brown (3) summarizes the investigations in progress on the psychology of handwriting and emphasizes Meumann's work as most significant, particularly his investigation on the various types of pressure curves. Rusk (12) urges the claim of speed as a present day requirement and hence the need of a study of the forms of movement most adapted to producing speed. Drever (7) also calls attention to the value of an investigation of writing-pressure as a means of studying "both the writing impulse itself, and the extent to which coördination of movement in response to the stimulus is present." Various methods of registration of writing pressure are given and a new method described of registering the pressure from the writing point instead of the pressure on a writing surface from the surface itself. Drever also emphasizes the need of an objective standard of merit for writing and criticizes as "scientifically unsatisfactory" such scales as those of Thorndike. We should seek a "numerical expression for facility of production, and for legibility." Starch (13) in a careful study suggests simple but accurate methods of evaluating legibility and productibility of writing. He finds that both the Thorndike and the Ayres scales are of value in measuring form and proves that measurements with such a scale as Thorndike's are, after practice, "from three to four times as accurate as evaluations made by the usual percentile marking system." Starch obtained samples, under laboratory conditions, of the writing of 2,190 children in the schools of Madison and measured these samples for speed, legibility and form with suggestions as to the possibility of working out a standard graph chart for each grade with reference to which the attainment of the individual pupil might be measured.

A most excellent study of pen-lapses is contributed by Stoll (14), who classifies these lapses into lapses of omission, addition, falsification, and substitution of words or word-parts, of letters or letter-parts. Stoll seeks to find the underlying causes for such lapses and makes much of inhibition of like or similar elements and

of perseverative tendencies. An interesting experiment in the artificial production of particular kinds of lapses is described.

A valuable historical work on the beginnings of writing is contributed by Danzel (4). Copious illustrations add to the value of the work. Throughout, the author shows the great significance of the religious motive in the origin and development of writing and takes issue with certain authorities relatively to the true antecedents of graphic expression. In the first chapter are described a number of devices (place-marks, number-marks, marks of ownership, etc.) which are analogous to writing inasmuch as they serve communication and as memory-props and so prepare for such a use of technical mnemonic symbolism as writing brings to completion. Drawing for purposes of communication does not develop from playful drawings as was supposed at one time. In the symbols of magic we find a proper foreshadowing of writing, for here we find an element of general and abstract significance which is conserved since the symbols of magic are religious objects. The second chapter discusses the various forms of picture-writing, which, for a long time, serves religious purposes almost exclusively. Little by little as a means of expression this becomes extended through linkage with forms learned from playful drawings and through application of gesture-speech. The predominately motor preoccupation of the negro caused the creation of a gesture speech-type in Africa through direct graphic fixation of a gesture; the necessity of creating a system adapted for communication with the absent explained the creation of a pantomimic picture-writing among the Eskimo. The third chapter discusses phonetic writing. On account of the increasingly manifold application of ideograms, in the course of development great ambiguity would arise. Speech would have attained much earlier a specialized and detailed expression, it would seek to appropriate picture-writing. At first, therefore, with the picture of an object one gives the name of a like-sounding, like-named object. Later a transition is made to a more complete phonetic analysis and to a linguistic assimilation of picture-writing, a transition prepared for by word-plays, rhymes, secret languages, for here already a phonetic analysis had taken place.

Barr and Crow (2) report the case of a man who "whenever he makes any complicated voluntary movements with the fingers or wrist of either hand the other hand involuntarily makes the same movements." As an instance of these associated movements of

the two hands left-hand mirror-writing results. The authors adopt the conventional but somewhat questionable explanation that mirror-writing is the natural left-hand writing of right-handed individuals and offer as a hypothetical explanation of the general condition the fact that inhibition by means of which restricted movements may take place is but slowly acquired and has never been acquired by the patient for hand movements.

Yoakum and Calfee (18) present a report which, while exhibiting primarily certain features of the learning process, shows that in discussion of the mental traits involved in voluntary mirror-drawing it is necessary to carry the test on beyond an initial one since the presence of distinctive learning types complicates the situation.

Meyer (9) gives a valuable account of results in reproducing a number of figures. Both adults and children were employed as reagents. A record is kept especially of the frequency and kinds of shift in position of the figures reproduced and a study made of the factors conditioning such shifts. Children, more frequently than adults, err in reproducing position, giving samples of mirror-figures or inverted figures or figures both inverted and reversed. Certain interesting errors in size also occur; children are more inclined to decrease and adults to increase the size in reproduction. Throughout, individual differences are shown to be very striking.

Interest in the development of drawing capacity in the child is still high as shown by the appearance of a second edition of Rouma's important work (11).

Thorndike (16) contributes a provisional scale for measuring achievement and improvement in drawing. "One merit, the unit of our scale, is the difference of merit in children's drawings which 75 per cent. of artists, teachers of art and intelligent judges generally can distinguish, and which 25 per cent. of them fail to distinguish." The scale was obtained by getting the ratings of three hundred and seventy-five judgments on fifteen chosen drawings. The limitations of the scale and the problem of its extension are discussed by the author.

Ballard (1) supplements a former report on the drawing preferences of London children by a second report on the preferences of children in the rural Celtic communities of Great Britain. Classification of 10,000 drawings gives results very similar to those obtained with the London children. A continuation of the report of Stern's statistical investigation of the drawings of school children produced in illustration of a given theme is made by Wagner (17).

Classification is made of the choices of possible motives and per cents of frequency are given for representations of movement, of the human figure, indications of humor and the like. Four stages in development are recognized: (1) Representations without spatial relations; (2) Unbroken series of pictures; (3) Sheets of pictures; (4) Clearly arranged rendering of a theme,—a comprehensive picture. The per cent. of frequency with which each stage occurs in the different school classes is given. The figures indicate the superiority of the boys over the girls. In two short articles Decroly (5, 6) analyzes the elements involved in drawing capacity and finds them dependent upon vision and oculo-motor functions. These elements include the notions of direction, of proportion, of movement, of perspective, and power of mental (visual) representation. A series of simple preliminary experiments are described to determine at what age capacity for handling these various elements appears. It is found that, in general, the normal child exhibits such capacity after the tenth year.

The most notable work of the year on drawing is Luquet's copiously illustrated volume (8) which gives a detailed biographical account of the development of drawing capacity in the author's daughter from whom he collected, in chronological order, some 1,700 drawings. Luquet urges the need of such biographic accounts and criticizes statistical studies because they fail to give the conditions which produce the drawings investigated. He points out, however, the great difficulties in the way of a complete biographic study. Many requirements must be met, the observer must have complete records of both drawing products and environmental conditions. The child's spontaneity must, moreover, be preserved absolutely; it must be uninfluenced by imitation of a child companion. Throughout, Luquet distinguishes in a most interesting way the child's intention from the child's interpretation and explains the curious conflicts that may arise between these two factors.

Every individual in the development of drawing capacity is thought to pass through four ages. First, that of involuntary drawing. The child perceives that the drawings of others represent objects and that he himself is capable of drawing lines but he does not perceive that he can represent objects. This phase closes when the intention to represent develops. The second age is characterized by synthetic incapacity; the child perceives the details but cannot assemble them in coherent fashion. Logical realism

characterizes the third stage; the child draws not what he sees but what he knows. In the fourth stage the child attains visual realism, as shown by the entrance of perspective into this work. His drawings now differ from those of the adult only in technical skill. Temporary regressions may take place, during development, from a higher to a lower stage. The same regressions occur in pathological cases. Art, historically, is found to pass through the same stages.

The child does not draw things as he sees them; he copies an internal model, a generic image, according to Luquet, who draws some interesting conclusions as to infantile psychology. These observations speak against associationism and brute empiricism; the fact that the drawing proceeds from the whole to the detail indicates that a selective activity directs the mind of the child.

In a critical article, Näcke (10) urges the importance of study of the drawings of the mentally diseased. Numerous obstacles stand in the way of accurate study; for example, the relatively small collections of such drawings that have been made up to the present time and the difficulties, as well as expense, involved in reproducing them. Näcke cites the characteristics of the drawings of patients suffering from different forms of mental disease so far as any general conclusions seem justified. The paranoics draw most frequently; catatonics produce few drawings, but these show repetition of motives and stereotypy to a high degree; mental weakness exhibits itself in evidences of failure of attention and of perception; maniacs exhibit incoherence. In all interpretation great caution must be observed and, if possible, drawings of the same patient in normal conditions should be used in comparison.

In his summary Näcke emphasizes the following points: Drawing and other artistic activities on the part of the mentally sick are comparatively rare, rarer than in the case of the normal person. The drawings that have been collected up to the present time are too few in number to justify dogmatic conclusions. Only after a comparison of such drawings with those produced by the same persons in health could one reach a satisfactory conclusion. In the case of a given patient as many drawings as possible from many different periods of his sickness should be collected. Normal drawings may alternate with the abnormal and the changes are important for diagnosis. Only at the height of the disease and for a certain intensity of the same do drawings show with moderate (never absolute) certainty the nature of the disease. In light sickness, in the

beginning of serious illness or in convalescence nothing characteristic is produced. In themselves all art products are more ambiguous than oral or graphic activities and the motives are often more obscure and hence of less significance. The infantile characters of many such drawings may be due to the low educational level of the patient and have nothing to do with atavism. Näcke is critical of the common view that pathological drawings show regression to earlier stages in the development of drawing capacity. Such regression could be shown only by a series of drawings. Artists and literary persons suffering from mental disease show in their art products the same deviations as the untrained but, in general, at a later stage and in less pronounced form for a psychosis of equal intensity. In both cases there is, fundamentally, only a departure from a personal style.

Trepsat (15) gives a résumé of the case history of a patient with dementia praecox and furnishes plates that reproduce the drawings and writing of the patient. Verbal incoherence is evident in the samples of writing and in the drawings both incoherence and stereotypy appear but in connection with some unusual features that show conservation of memory, excellent orientation and power of observation.

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VOCAL FUNCTIONS

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A sound psychology of the mechanism of speech is a primary desideratum of the phonetician, the corrector of speech defects, the psychiatrist confronted by aphasias, the teacher of foreign tongues. Yet, if one of these workers in applied psychology should join the student of pure theory in a rapid excursion through the literature of 1913, his first reaction might well be a mild bewilderment. What, for example, is the relation of the verbal image to the vocal act? And what share has the motor process in determining consciousness of word-meaning?

On these points, Bluemel (2) holds to the traditional views, while finding a novel application. With a fund of information about stammering gathered introspectively as well as at second hand, he writes a two volume treatise whose main thesis is that stammering is a form of auditory aphasia. Stammerers are always "auditory-moteurs"; and their failure to articulate is due to their inability to command the necessary auditory imagery. Their kinæsthetic imagery gives them control of the initial consonants, and then the aphasia which robs them of the auditory image of the vowel quality of the word, prohibits further progress in vocalization. Sound treatment will, then, undertake to reeducate the speech processes in such a manner that kinæsthetic imagery will

take the place of the troublesome auditory imagery, as the essential antecedent and guide of speech.

Meanwhile Froment and Monod (5) contend that there are no verbal-motor images, and undertake to explain both the phenomena of normal utterance and also the facts of motor aphasia without recourse to the motor image of the traditional theory of volition. Only the existence of sensorial images, visual- and auditory-verbal, can be demonstrated.

Claparède (3) leaps to the defense of the verbal-motor image, and makes it clear that verbal-motor phenomena may at least be independent of auditory and visual cues. Flagstad (4) swings to the extreme of maintaining, not merely that the verbal-motor image is an essential constituent of all word images, but also that "for the memory of a sound, the connected image of movement is of prime importance, and that the necessary condition for the union of the sound image with the rest of the content of consciousness is its fusion with the images of space, of material, and of movement."¹ Hence the necessity for active utterance in acquiring the sounds and meanings of a foreign language.

Wyczolkowska's (16) observations and experiments in the mechanism of speech were suggested by her general convictions regarding the place of motor factors in thought processes; but it is here a question, not of imagery, but of actual movement. Analysis of an elementary thought process discloses three stages in its development: (a) the automatic initiation of organic processes connected with attention, including muscular activity partly inhibitive and partly facilitatory; (b) a stage of unconscious tension and of only partially defined expectation of the results to follow upon attention; (c) the appearance of the articulate word-form which intellectualizes definitively the thought process. This third stage does not appear until the impulses connected with the activities of attention stimulate the speech organs to engage in synthetic action. The order of events is different when one hears a word pronounced. The hearer's speech mechanism is stimulated; and conscious understanding becomes clear only when the word is in this faint sympathetic fashion repeated by the hearer.

Dr. Wyczolkowska first describes a hitherto unnoted reflex connection between the thenar eminence of the thumb and the tip of the tongue. A possible nervous pathway by way of the cervical plexus is pointed out, and the reader is led to suspect that here we

¹ Cf. review by SECHRIST. *Amer. J. of Psychol.*, 1914, 21, 295.

have some sort of direct phonetico-graphical connection. Anatomical details of the topography of the nerves supplying the tongue and the ear point toward the possibility of close interconnection between these organs also. Another portion of the study is concerned with graphically recorded lingual movements that accompany both the hearing of spoken words and melodies, and also the mere thinking or remembering of similar material. Every thought produced some movement of the tongue. Thinking words produced virtually the same curve as hearing them, though thinking revealed greater intensity of impulse. A reader already favorably disposed toward motor theories will find even the meagre data here given most suggestive.

The fortresses of our ignorance regarding the nature of vowels and voice registers are being bombarded from many angles, boldly surveyed from above and even surreptitiously attacked from the rear. The most recent models of siege appliances have been perfected by Benjamins and Peters, who share the general lack of confidence in any device that resorts to the use of a vibrating membrane. Peters (10) photographs on a falling plate a shadow cast by a tiny drop of alcohol in a capillary tube, and gets remarkable pictures of the voice vibrations that are actuating this tiny fluid object, pictures resembling somewhat those made with a string galvanometer. Benjamins (1) has discovered the feasibility of employing Kundt's tubes for determining the chief tone of a vowel clang, the partial tone that has the greatest energy. He finds that as the pitch of the fundamental rises, the pitch of this chief partial also rises until a point is reached where it drops, or to put it differently, its prominence is taken over by the partial next lower in pitch. Comparing the results obtained with eight different vowels, the author concludes that the energetically strongest tone cannot be taken as the characteristic tone of the vowel; that, indeed, the vowel is distinguished not by any one formant, but rather by the whole picture of the intensities of the partials, a picture which varies with change of the pitch of the fundamental. Attention is called to the change of size of the buccal cavity that occurs as one sings a vowel from low to high pitch.

Wittmann (15) has vindicated the worth of Marbe's smoking flame method for the investigation of speech-melodies and of vowel sounds. His determination of the pitch of the formants characteristic of five different vowels, confirms measurements Hermann and others have published, and harmonizes most happily with the

results of Jaensch's (6) vowel syntheses, ingeniously made by varying the light thrown upon a selenium cell in circuit with a telephone receiver.²

Ter Kuile (7) maintains that the vowel components are not properly tones but noises. Each separate stroke of the vibrating vocal cords actuates the vocal chamber and generates a characteristic noise which varies with the size of the chamber, with the nature of its walls, and particularly with the "acuity" of the actuating stroke and the rapidity with which its effect is damped. An ingenious artificial-vowel apparatus enables the experimenter to determine the relative importance of these different factors. On such a theory as his, the analysis of a vowel-curve into a Fourier's series of sinus curves is physiologically false although mathematically possible. Ter Kuile's theory of chest-register, head-register and falsetto is made in terms of the different positions and tensions of the sound-generating organs, particularly of the glottis and the thyroid cartilage.

A new journal, the *Archiv für experimentelle und klinische Phonetik*, was launched last September with Katzenstein of Berlin at the helm. Its first volume, with several important titles will be reviewed next year with the literature of 1914.

Vox continues to publish the invaluable *Bibliographica Phonetica* compiled by Panconcelli-Calzia. Beginning with the current year the many titles are conveniently grouped by subject instead of by author which facilitates the search for material of psychological interest. Every issue of the journal contains also original articles from which the student of the psychology of speech and song may glean suggestions (9, 13, 14). For example, one of Peters's (10) methods of enlarging gramophone records, suggests a simple attachment which could be added to Seashore's tonoscope,³ to permit the taking of a permanent graphic record of critical tonoscopic experiments; and at the same time, one is led to speculate on the adaptability of that same device of Peters's, to facilitate making tonoscopic measurements of phonograms.

² See the description by R. M. Ogden, in his summary of the recent literature on Hearing in this *BULLETIN*, 1914, 11, 96.

³ Seashore, C. E., *Psychol. Monog.*, 1914, No. 69. This recent important monograph will be reviewed in the next annual summary.

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SPECIAL REVIEWS

History of Psychology. A Sketch and an Interpretation. JAMES MARK BALDWIN. New York: Putnams, 2 vols. 1913.

In his *Darwin and the Humanities* Baldwin once declared natural selection to be a universal principle with varied applications in the sciences of life and mind. One application of the Darwinian principle is now furnished in Baldwin's latest work, a *History of Psychology*. The point of view adopted is that of a parallelism between racial reflection and individual thought in the theories about the mental principle or self. To get any advantage from such a principle we should have to discover that the racial stages in the interpretation of the self have been unrolled "concurrently," or in the same serial order, with the stages of development of individual self-consciousness. There is more than analogy in the parallelism between racial evolution and individual development. We speak of the childhood of the race and its growth into maturity. This suggests that in social evolution we may see a restatement of the great stages of individual development; that individual thought may show stages which recapitulate those of racial evolution—a parallel similar to the recapitulation recognized by biologists in the evolution of organisms. The individual's development in consciousness of self recapitulates, we should then say, the evolution of self-conscious reflection in the human race. We find, therefore, in the history of thought about the mind four great periods: The Prehistoric or Prelogical; the Ancient or Unscientific; the Medieval or Substantive; the Modern or Reflective.

Found among primitive peoples the prelogical period corresponds to the early a-dualistic period of the child's apprehension of the self. Deadness or lack of animation was overlooked in aboriginal times, all things being found to have a mysterious sort of agency similar to that of personal agents or actors. The infant repeats this in failing to distinguish between the bodies that are really selves or conscious beings and those which are merely dead or inanimate things. His fondling or striking inanimate bodies is like the savage who looks upon everything as having an indwelling soul—good or bad. But once the distinction is made between

thought and things, psychology as such is possible. Nevertheless, in the first stages of emergence, the race, like the child, still clings to the fringes of the past. Thus in the history of psychology the early Greek period corresponds to the unreflective stages of the child's thought of self, the period of the origin of dualism. It is unreflective in the sense that in this period the view of the self is not exact or critical, not the subject of distinct definition, but remains incidental to the larger view of the world or nature taken as a whole.

As the child is dependent upon society for the materials of his thought, so were the first philosophers. The child imitates social "copy" and absorbs social tradition. So Thales, the father of Greek philosophy, though having a mind full grown for reflection, still depended upon society and its institutions for the material of his thought. Called upon to explain what he understood the self to be, he would have pointed to some fluid and subtle physical agent, saying that the self or mind was like that. Indeed, the first of the Greek thinkers would not have distinguished between mind and matter, because there still lingered the primitive view that all nature is living, dynamic, semi-personal. Into this animistic way of thinking Thales was born; out of it he could not wholly emerge. So the earliest group of Greek thinkers—the Ionians—represented the "projective stages," where the word is neither subjective or objective, but simply a panorama of changes projected before the eyes. Its explaining principles are not in any way isolated or differentiated from one another. Life is a sort of first thing, a crude general term within which more positive meanings are later on to be differentiated. With the Ionians this appears in attempts to refine away the crude features of the elements which are taken to represent life and soul. Air, warm air, heat, fire, are more subtle and thinner than the other elements of nature.

The Pre-Socratics are followed by the Sophists, and the Sophistic stand is, for the development of racial interpretation, what the dawn of the subjective era is for that of the thinking individual. The mind is thrown back upon itself through the ineffectiveness of its first efforts to understand things. Now comes the subjective phase—represented by the Socratic motto, "Know Thyself." Here the Sophistical conclusion that "the senses deceive" reminds the genetic psychologist of the condition of embarrassment in which the growing individual finds himself as he confronts the puzzle of his own body. Upon this follows fast the beginnings of a sharper dualism between the subjective and the external world,

between the mind as the seat of ideas and the world of things and of practical interests and values.

With Aristotle, according to Baldwin, we have the rise of a real objectivism, where the world, and not merely the self, is to be explored and understood. Yet for the real ripening of dualism we must have recourse to the Middle Ages, for only here, it is claimed, are we in the presence of the transition in racial thought from the spontaneous to the reflective type. This critical period has already been called the substantive period, so named from the fact that in it the great distinction arose between the mind and body as different and distinct substances. It corresponds to the stretch of development of the individual which culminates in a similar dualism. In the stage of immature dualism the body is at once a mere thing and also the intimate seat of the subjective life, but in the development of dualism, the hardening of the mind and body terms, the problem then becomes the reflective one, how can this be? How are the two substances related to each other? How can mind and body interact one with the other? From the point of view of theory, we call it the psycho-physical problem.

Baldwin has presented a system of psychology from the prelogical to the logical, and all from a genetic point of view. It forms an attractive problem whose value lies in its enlightening application of the doctrine of recapitulation. There is indeed a sort of comparative mental embryology in the development of the doctrine of the self. In the child we find an infantile reproduction of tradition, since the child, like the savage in the prelogical period, is a microcosm reflecting the larger macrocosm of social values, beliefs, rights and values. And this points back to the racial period of magic and fearful religion when the prime distinction is not that between spirit and matter, mind and body; but that between the seen and the unseen, the evident and the hidden, the clear and the mystic. Behind the curtain of nature which is projected before the eyes there is a seething body of agencies working for good and ill. For psychology, the period is a-dualistic both to the child whose self is the animated body, and to the savage whose entire world is a mass of animated things.

It is not hard to accept this generalization, fortified by the opinions of the anthropologists, for it has the further advantage of throwing much light upon the obscure origins of our Western speculation. With the Greek thinkers before Socrates dualism means a departure from the flat, curtain-like vision of the pro-

jective period in the direction of the apprehension of a cleft in nature between the dead and the living, between agencies and effects. It brings forward the agencies which were behind the curtain, and defines them as in some sense minds. A first sketch is made of the distinction between those things that have a self and those that have not.

We can also agree with the statement that in the clearing up work of the pre-Socratic School the seed of subjectivism was sowed, for it led the Sophist to bring out the real meaning of the saying "The senses deceive," and it led Socrates to emphasize the need of individual self-consciousness. Baldwin can point out in the Greeks a capital instance of the dawning of the sense of subjective personality. But to leave the development of dualism to the Middle Ages is to leave the Hellenic race in a state of perpetual adolescence. The doctrine of the complete recapitulation can find no better illustration than in the Greek thinkers. Gomperz has pointed this out in his last volume on Aristotle. The Stagirite sounded the depths of dualism, but the post-Aristotelians, especially the Neo-Platonist, as if struck with a philosophic senility, became mere repeaters of that earliest period, the prelogical. But along with a small and yet complete cycle of recapitulation, as in the rounded history of Greek speculation, there is also to be considered the larger cycle evident in the general history of psychology. The inner wheel of Greek thought does not describe the full orbit of racial thought, nevertheless, as racially typical, it actually anticipated the path of later speculation. The author grants as much when he says: "Darwin took the problem of 'matter and form' out of the hands of the psychologist who treats of the individual, and made it again the genetic and historical problem that it had been to Aristotle and his Greek predecessors. . . . The Darwinian genetic naturalist asks: What are the stages of racial history through which the individual has acquired his endowment? The conclusion then is this: Thinking having appeared, it is evident that reflection may take on protean forms. Modern psychology reflects the alternatives which philosophy has worked out in its varied systems, so far as these concern the mind. Looking upon the movement of thought as it appears in perspective, we see the early alternatives reproduced each for itself, with critical and historical justification, in the modern period. It is in respect to variety and refinement of enterprise, to richness of data and power of criticism, to sobriety of method or its opposite—deliberate

speculative license—that the analogy with the individual now holds good. Positivism, rationalism, and immediatism—science, philosophy, and faith broadly understood—are the modern alternatives. As in modern culture, so also in individual thought, the choice among them is largely a matter of temperament."

In this historical résumé Baldwin presents the main thesis of his work. For those who adhere to the doctrine of recapitulation the genetic interpretation of the history of psychology is valid. But as that doctrine is impaired, so is the interpretation. Yet even in the latter case Baldwin's work would have value. Recapitulation would form a mnemonic scheme by means of which the student could quickly grasp the main lines of development in the successive interpretations of the mental principle. A knowledge of this development we hold to be extremely valuable at the present time. Our text books in psychology suffer from a lack of historical perspective. His work will supplement them, since it furnishes the background of controversy out of which various theories have arisen. The controversial tone of the ordinary book often confuses the beginner. He should be told against whom the author is fighting, otherwise much of the text seems a waste of energy, a battle against straw men.

Another advantage of such a presentation as this is as an antidote to narrowness; a knowledge of the history of psychology prevents adherence to any one school, and this preserves that state of suspended judgment which is the very atmosphere of scientific advance. In the recent attempt to divorce philosophy and psychology—which has gone so far in America and is threatened in Germany—it may be well to remember that there is such a thing as the metaphysics of psychology. Now in tracing the speculative connections between different psychological schools, in presenting the metaphysical difficulties from which psychologists have extricated themselves Baldwin has performed a notable service. Nevertheless we can hardly believe that in the modern alternatives as to the various schools the choice is "largely a matter of temperament." The author himself shows that it is not so much the temperamental as the logical which determines the issue. For example, he explains how psycho-physical parallelism was a compromise between the idealistic and materialistic interpretations in the body-mind controversy, and yet how, at present, it proves more and more difficult to hold either alternative, mechanical or vitalistic, as final. Again, in the conflict between the individualistic and social inter-

pretations, a genetic psychology includes both elements, revealing the state of the individual mind in given social conditions.

But compromise may be carried too far. So Baldwin is no mere board of conciliation. In his chapter on philosophical psychology he shows how certain points of view have disappeared for good and all. Thus the Herbartian mechanism displaced the faculty psychology, just as "organic selection" is displacing the lapsed intelligence theory. In the latter connection we may point out a slight misinterpretation of Bergson, when it is asserted that he supposes an intrinsic, internal directive force in the life-process, by which functions are determined "wholly or largely in independence of the action of environment." This is hardly borne out in Bergson's emphasis upon the stubborn and obdurate rôle of matter in creative evolution. A lapse like this is rare and more than compensated by the author's restoring to the balance of power such a thinker as Herbert Spencer. He points out how the psychologist's debt to the synthetic philosopher has been but grudgingly paid, and implies that the reason why many British writers find it impossible to do any sort of justice to Spencer is because of the vogue of Spencerianism in the Latin countries and the United States.

In these "general points of view" in the scientific psychology of the nineteenth century Baldwin has furnished what might be called a first reader for students of psychology. With Max Dessoir's work as a supplement upon the ancient thinkers, this should be made required reading in our colleges, in order to prevent that lamentable lack of historical perspective from which so many of our young experimenters suffer. In taking up "special lines of work" the author, except for his favorite social psychology, is cramped for space. Physiological, experimental, genetic, animal, comparative, affective, and æsthetic psychologies are crowded into two chapters. Much of this material has been previously treated by the author in his *Story of the Mind*. Here is need either of a revised edition of that popular work, or an enlargement of these crowded chapters in the present volume. Not only should students be shown their bearings in their own special lives of investigation, but the general reader should be informed of the wealth and variety of problems which modern psychology affords.

WOODBRIDGE RILEY

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Grundzüge der Psychotechnik. HUGO MÜNSTERBERG. Leipzig: Barth, 1914. Pp. xii + 767.

This book is a rewriting of the lectures given by Professor Münsterberg as exchange professor at the University of Berlin. In the preface the author states that he strives to accomplish three things: to present the principles that underlie psychotechnics; to organize and systematize all the parts of psychotechnics; and to stimulate to further work in psychotechnics. The book is declared to meet the special needs of nine classes of readers: psychologists, lawyers, physicians, teachers, artists, manufacturers, politicians, historians, and natural scientists.

Although the book contains 779 closely printed pages, it is said to be but the sixth volume of a series on foundations of psychology. The titles of these six volumes as planned indicate the place intended for the present volume. In sequence the titles are as follows: *Grundzüge der Psychologie*, *Kausale Individualpsychologie*, *Kausale Sozialpsychologie*, *Teleologische Psychologie*, *Kulturpsychologie*, *Psychotechnik*. Psychotechnics is defined as the science of the practical application of psychology in the service of the tasks of civilization. Just how it is to be classified and interpreted is made clear by its relationship to the proposed volumes which are to accompany it. "Kulturpsychologie" like psychotechnics is a branch of applied psychology. But the former is merely theoretical and the latter practical. The former explains events already in existence; the latter assists in producing results in the future. Psychotechnics is totally different in point of view from the proposed volume on "Teleologische Psychologie." The former regards only causal relationship; the latter only purposes. This distinction is regarded as especially important by the author and is insisted on throughout the volume. Readers not interested in this philosophical distinction may feel that the author could have restricted the discussion to an appendix or have reserved it for the forthcoming volume on "Teleologische Psychologie."

Although the bibliography cites approximately seven hundred works having to do with applied psychology, the present volume is the first to attempt to present a general view of the entire field of psychotechnics. Following a discussion of the factors which have delayed the advance of applied psychology and of those which have favored it, the author ventures the prophecy that in the near future every higher institution of learning will have a professor and a laboratory of applied psychology.

Almost two hundred pages are devoted to the general discussion in which are taken up such topics as in the limits of psychotechnics, principles underlying mental tests, tests available for psychotechnics, methods of applying tests, correlations, influencing others, influencing one's self, etc. The main part of the book is the seven chapters dealing with these special fields: Social Control (Gesellschaftsordnung); Health, Industry, Law, Education, Art, Science. These individual chapters are neither condensations nor elaborations of previous writings bearing similar titles. Each chapter has points of similarity with the previous contributions, but this latest presentation is the work of maturer years and was written for a learned German audience.

Because of his universality of interests, his breadth of learning, and his prophetic vision Professor Münsterberg is peculiarly well adapted to write this work on Foundations of Psychotechnics. It crystallizes the scattered work of hundreds of independent workers and demonstrates the drift of modern psychology towards the practical.

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Zur Grundlegung der Tonpsychologie. G. RÉVÉSZ. Leipzig: Veit, 1913. Pp. 148.

Révész says, in the preface to this treatise, the traditional view is this, that "pitch or quality or whatever you call that musically interesting attribute of auditory sensation, as distinguished from intensity, timbre, and vocality" is to be represented by a curve without any inflexion points. This view he combats. The reviewer, however, fails to see that any psychologist during the last twenty years has really supported such a view, however common it may be among laymen in psychology. For example, tone "relationship," as Helmholtz calls it, is represented by Helmholtz by a curve having many inflexion points. According to Helmholtz, however, this tone relationship is nothing fundamental, but the result of habit, of associations of ideas of one or another kind. This view is popular among physicists and has in recent years been remodeled by one of them, Sabine; among psychologists it is a lost cause. Stumpf's fusion is represented by as many inflexion points as Helmholtz's relationship. The tonal fusion of Stumpf, however, is not the result of habit, but is a fundamental property of tone sensation. The reviewer has always supported the same view that

the musically most interesting attribute is a curve with many inflexion points, and that it is an attribute of sensation, that is, something fundamental, not reducible. Révész supports the same view. On the other hand, Stumpf's theory of fusion is like Helmholtz's in assuming that "fusion" in successive tones, in melody, is not fundamental, but a mere habit of perception. Révész regards it in both simultaneity and succession as fundamental, rightly, as the reviewer has always been convinced. He reached this conclusion without realizing, at the time, that it had been reached and published at about the same time by Köhler and many years before by the present reviewer. In the present book Révész states: "Meyer's arguments . . . are correct . . . but not sufficient for such an important theory, and that is probably the reason why psychologists have not accepted them." The truth is rather this. There are very few psychologists who are extensively and intensively interested in the psychology of tone and music. And those not thus interested simply paid no attention to the theory, whether important or unimportant, correct or incorrect. Now we see that the only two psychologists who, experimentally and theoretically, have in recent years studied the fundamental problems of musical perception, have reached the same conclusion reached by the reviewer. I have no ill feelings toward them on account of reaching this conclusion independently of me, and of each other. This is so much the better, because it proves that we are right. And, may be, other psychologists will now pay a little more attention to the conclusion than before it had been reached independently by three.

But, unfortunately, there is the terminological difficulty. In my paper on the attributes of sensation¹ I spoke of the attributes of pitch and quality, pitch being the musically most important attribute, represented by a curve of many inflexion points, quality being the musically less important attribute. I referred to judgments about similarity in pitch as judgments about degrees of tone relationship. Helmholtz would have used the same term. Stumpf would use the term degrees of fusion. Similarity in quality I called "similarity" in the narrower sense. Helmholtz and Stumpf would use the same term. Köhler, without knowing my terms, called "Höhe" what I called pitch, and "Vokalität" what I called quality. This is not bad except that Köhler, after learning of my previous efforts in the matter, continued to think that his vocality and my quality meant two entirely different experiences, when we

¹ PSYCHOL. REV., 9.

were actually speaking of essentially the same experience,—just because he had happened to give it a different name.

But now comes Révész and, unwittingly, calls "Höhe" what I had called quality, and "Qualität" what I had called pitch. The result is that whenever we are speaking of identical experiences we use opposite terms, and identical terms whenever we are speaking of opposite experiences.

I believe that the best way out of this dilemma is to adopt the terms tonality and vocality for the two attributes in question. In music tonality would then be the more important one; in speech vocality would be the more important attribute. I shall henceforth use this terminology. Tonality = Révész's "Qualität," vocality = Révész's "Höhe."

The most important contents of this book (but largely published already in magazine articles by the same author) seem to be the following. First, experiments on a subject (Liebermann) who has a peculiar psychological defect, which permits him to demonstrate more clearly than this has ever before been possible the necessity of distinguishing as absolutely fundamental tonal attributes tonality and vocality. While another defect, the lack or weakness of tonality together with a fair degree of vocality is not infrequent among so-called unmusical persons, Liebermann's defect is rare. He possesses a difference of tonality in the two ears, while the vocality in the two ears is the same.

Second, Révész seems to establish beyond doubt what has been hinted at by the reviewer years ago, that the distinction between tonality and vocality is essential for the understanding of the so-called memory of absolute pitch. Révész clears this question up considerably by demonstrating that there are probably two kinds of such absolute memories, one in the one attribute, the other in the other attribute, and that a person may have either the one, or the other, or both, not to speak of a poor memory in both, which is, of course, the logical reverse of a good one.

Third, Révész demonstrates that musical intervals, their perception and judgment, are also of this double nature. A musical interval is a definite interval either in the sense of representing a definite distance or span in vocality, or in the sense of representing a definite relation of tonality, or, sometimes, in both senses at the same time.

The reviewer agrees with Révész that the foundations upon which a theory of music can be built must be such as stated here

(excepting the confusing terminology, for which, however, the author should not be unduly blamed). But the actual building up of a theory of music upon such foundations has barely been attempted by Révész. This attempt at a theory of music is confined to the last sixteen pages of the book under the two headings "Segmenttheorie" and "Harmonie und Melodie," or rather, to a few among these sixteen pages. This treatment of the problems of music, while interesting to the specialist, is too sketchy for a detailed criticism in a review.

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NOTES AND NEWS

PROFESSOR R. M. OGDEN, of the University of Tennessee, has accepted the professorship of psychology at the University of Kansas.

PROFESSOR T. H. HAINES, of the Ohio State University, has been appointed director of the psychological bureau for the study of juvenile delinquents now being established by the State Board of Administration of Ohio.

A SPECIAL department of the New York University School of Pedagogy has been organized for the training of teachers of backward and defective children. Professor James E. Lough has been appointed director of the department.

THE GENERAL European war has apparently caused a suspension of most of the foreign scientific publications on the continent. No German or French psychological publication has been received with date of publication subsequent to August first. Announcements have been made in *Nature* that the English universities will be opened as usual. No information has been received regarding the continental universities, but it is believed that all have temporarily suspended. A number of American psychologists who were abroad at the outbreak of the war have been reported to have sailed, or to have arrived safely in this country. It is supposed that Professor F. M. Urban (University of Pennsylvania) is with the Austro-Hungarian army.

